

From
Can. Inst.
M.

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COMPLIMENTS OF
MACLEOD STEWART.

The Montreal, Ottawa and Georgian Bay Canal.

ESTIMATE OF VALUE OF WATER POWERS.

With regard to the development of water-power on the Ottawa and its tributaries owing to the construction of the works necessary for navigation, it is to be noted that the conditions are almost ideally favorable to the production of immense power which will be a valuable source of revenue.

1. The Ottawa is a stream of great volume, having a maximum flow (at Grenville 35 miles from its mouth) of 150,000 cubic feet per second, a minimum flow of 34,000 and a mean flow of 85,000 cubic feet per second, and falls step by step in a manner almost perfectly adapted to the economical utilization of the highest possible percentage of its water power.

2. The total lockage (430 feet) is distributed at various points along the river, the fall of the stream being concentrated at definite points, the fall at each being neither too small nor too great for economical development.

3. The river is generally narrow where falls occur and the walls high and rocky, rendering the construction of dams less costly, and making the utilization of a large proportion of the theoretical power generated practically and economically possible.

4. The falls are permanent on account of the hard nature of the rocks which cause them, and powers developed will for that reason neither be subject to rapid deterioration owing to changes in the river bed, nor will great expense require to be incurred frequently to maintain their efficiency from year to year.

5. The climatic and physical conditions are favourable. The country is covered with extensive forests which regulate the flow of the water, retard the drainage from the winter snows, and free the river from spring freshets which are so destructive to works erected on many streams elsewhere. The rise of the Ottawa in the Spring is slow and gradual and its subsidence the same. Very numerous lakes, many of them of large size, afford a system of natural reservoirs for the increase, regulation or control of the water supply, superior to anything that could possibly be devised.

These water powers, by the opening of the Ottawa River to navigation, will be brought directly on a most important line of continental through traffic. This will be of the utmost significance with regard to a possible milling industry which will convert the grain of the Canadian North West into flour on its way to the English market. The Canadian Pacific and other railways are contiguous to the river, giving also excellent facilities for shipping by rail. The shipping facilities, the nearness of the supply of pulp wood, and the

plentiful supply of pure water should make the Ottawa the seat of a pulp and paper manufacturing industry of large proportions.

These and other facts justify the statement that the valley of the Ottawa will compare favourably as a water power district with New England which contains about one-third of the utilized water power of the United States, and is regarded by authorities as exemplifying the ideal condition of things considered as a water power country.

The Niagara Falls generate theoretically somewhere near 7,000,000 horse power, of which however only a small part can be used to advantage. Few measurements of the flow of the Ottawa River at the various points where rapids and falls occur have been recorded (with the exception of the survey measurement at Grenville above referred to), so that it is impossible to give any accurate estimate of the theoretical water power generated by the various falls; but it is the opinion of the engineers acquainted with both streams that the aggregate power of the Ottawa is not far short of that of Niagara if not equal to it. Estimating it at 5,000,000 h. p. and supposing only five per cent. of this to be practically available, that will give 250,000 horse power. The dams erected at various points to maintain permanent water levels for navigation will be the means of developing this power. If one third of the readily available power on the immediate route as estimated above, be utilized, the amount so utilized will be 75,000 horse power. That this is an extremely low estimate is shown by the fact that a single dam at the Little Chaudiere Rapids above the Chaudiere Falls near Ottawa is expected by engineers who have made examinations for it to furnish 20,000 horse power. The value of the power developed depends on shipping facilities and demand with possibility of profitable employment, but \$20.00 per horse power per annum, an aggregate of \$1,500,000 yearly for 75,000 h. p., is a low estimate of what it is worth.

ESTIMATE OF TONNAGE.

In any calculation of the amount of traffic to be expected it is important to take into account the great advantages of the Ottawa route over all others in point of distance, cheapness, safety, &c., as already set forth in the prospectus and elsewhere, which may affect its success as a competitor for through traffic. A more direct comparison with the Erie route may be of assistance also in forming a just estimate.

The possible eastern terminal points of all waterways from the lakes to the Atlantic are New York and Montreal. While local prejudice and other causes may lead to the favouring of one or other of these, it is to be noted that the Erie reaches the former alone, but that the Ottawa affords

1. A route to Montreal from 300 to 400 miles shorter than that by the St. Lawrence, and
2. An alternative route to New York as short as the Erie and in some respects superior to it.

In addition to this, owing to its extension southward to New York passing through Lake Champlain, it will give the shortest possible waterway between New England and the Western States having an advantage of more than 300 miles in distance over the Erie in this respect, with 350 miles less canalling.

For the purpose of the following comparison, Chicago is selected as the western terminus. Were Duluth taken, or any other more northerly port, the advantage on the side of the Ottawa would be still more pronounced. By means of that route steamers would reach Montreal from Duluth in little more than the time it takes to reach Buffalo.

Chicago to New York.	
1. Via Erie Route	Miles
Lakes to Buffalo.....	920
Erie Canal.....	351
Hudson River.....	146
Total	1417 miles.
2. Via Ottawa Route.	
Chicago to Montreal.....	980
To Boundary line via Sorel.....	127
To Champlain Canal.....	111
Champlain & Erie Canals.....	72
Hudson River.....	146
Total	1437 miles.

The construction of the link between Lake St. Louis and Lake Champlain would reduce the distance by the Ottawa route as follows:—

	Miles
Chicago to Lake St. Louis.....	960
Lake St. Louis to Richelieu R.....	35
Richelieu R. & L. Champlain.....	134
Champlain Canal & Hudson R.....	218
Total	1347 miles

With a reduction of 90 feet lockage.

While it is thus a few miles farther by the Ottawa route so long as the circuitous course via Sorel is adhered to, it will be seen that the completion of the connecting link spoken of will give, in connection with the Ottawa Canals, a waterway to New York fully 60 miles shorter than the Erie. Nor is this its only advantage, for with the same lockage there is very much less canalling on the Ottawa route.

Erie Canal.....	Total canalling. 351 miles.
Ottawa route	
(a) Ottawa & Lachine Canals.....	30
(b) Chambly Canal.....	11
(c) Champlain Canal.....	72
	113 miles.
Or on completion of the Lake St. Louis Canal	
(a) Ottawa Canals.....	22
(b) Lake St. Louis Canal.....	27
(c) Champlain Canal.....	72
	121 miles.

The difference of 240 miles of canal, other things being equal would give the Ottawa route an advantage over the Erie between Chicago and New York of about 40 hours. The consequent gain of about three days on each round trip would more than compensate for any advantage the Erie may possess by reason of the somewhat longer season during which it is open.

The sources from which the carrying trade of the canals may be expected are two, viz :—the through traffic between the Great Lakes and the seaboard at Montreal and New York and the New England States, and traffic originating in the vicinity of the new line of navigation and to be developed by it.

The tonnage passing Detroit annually exceeds 25,000,000 tons and in five years time at the present average rate of increase will be over 30,000,000. Over 12,000,000 tons a year pass the American Sault alone, and the traffic at that point will not be less than 15,000,000 annually in five years from the present time. The American free grant lands being almost entirely taken up, a large movement of population to the immense fertile area north of the boundary line is certain to take place in the near future. The great need of that country is however an outlet for its products affording cheaper means of transportation. The excessive cost, as well as the problematical success, of the establishing of waterways on any line capable of admitting ocean vessels to the lakes, and the impracticability of the Hudson's Bay route (among other reasons because of the short season of navigation, the requirements of expensive ships specially fitted for the route, and the impossibility of moving any portion of a crop during the same year in which it is harvested) make it certain that in the opening of the shortest route between the lakes and tide-water lies the practical solution of the difficulty. So that, while itself deriving benefit from the growth of population in the North West, the Ottawa route will in turn be a means of promoting that growth. That the Canadian traffic from Lake Superior will rapidly increase, there is thus every reason to believe. Although a considerable portion of the traffic through the Sault consists of iron ores for Lake Erie ports, with its superior facilities and advantages for carrying the through traffic making its way from the Western States and Canadian North West to the seaboard or New York and New England, the Ottawa should succeed in obtaining for itself such a proportion of the traffic as would give it at the least calculation one-twentieth of the whole, say 750,000 tons.

The total through traffic of Lake Michigan may be fairly estimated at 18,000,000 tons upon the completion of the proposed canals, if constructed in five years time. Probably for not less than one-fifth of this the Ottawa would be the most advantageous route. That one-tenth of the whole will be attracted to it cannot be looked upon as an exorbitant claim. This will give 1,800,000 tons from that source.

Coal is the one thing lacking and essential to the development of the great northern districts of Ontario and Quebec which possess unsurpassed timber and mineral resources, magnificent water powers, a fine healthy climate, and much land capable of settlement. By bringing cheap coal to the shores of Lake Nipissing and the whole upper Ottawa, all activities in those districts would be greatly stimulated. The projected James Bay Railway would unload its coal supply from vessels at North Bay as cheap as railways on the front can now obtain it. The grain fleet carrying through freight from Chicago, Duluth and Port Arthur would make French River their coaling station. Thus vessels would find a lucrative trade plying from Lake Erie ports with coal, and taking return cargoes of lumber. From this coal

traffic for the whole Ottawa region, and all other originating on Lakes Erie and Huron, an additional 250,000 tons may be expected.

The lumber traffic would, at the outset at least, and probably for many years, be of great magnitude, and a very important source of revenue to the canals. For ten years past the canals of the lower Ottawa, available to only a limited portion of the trade, have carried over 650,000 tons of products of the forest annually; while the amount of such freight carried by the railways of this country in 1893 was over 4,500,000 tons. The timber districts of the Ottawa valley and the country most readily accessible from it on the height of land, with an area of over 26,000,000 acres, constitute the most important depot of red and white pine remaining on the continent, besides containing immense quantities of spruce, poplar, birch, tamarac, elm, maple, basswood, ash and other merchantable woods. Owing to the gradual exhaustion of American forests, and the rapidly increasing consumption of lumber, these northern woods must be more and more drawn upon to supply the demand. Practically therefore, the traffic will be limited only by the supply. Under present conditions, either all timber must be conveyed long distances to the mills at a great expense for carrying waste material, or, the mills being erected anywhere near the limits, the cost of transportation of dressed lumber by rail is high. The proposed navigation will affect the lumber trade in at least two ways:—

1. By its means the main tributaries of the Ottawa will be made to debouch upon a highway of traffic, water powers on the various streams now useless for want of transportation facilities will be made available for the manufacture of lumber nearer its place of production by hundreds of miles in some instances, and the cost of transportation of dressed lumber from the mills will be so materially reduced as to place the lumbermen of this whole region in a much better position on the markets in competition with others.

2. In addition to this it will afford a choice of market. The lumberman from the head waters of the Ottawa having reached Mattawa will be able either to avail himself of the present eastern markets to much better advantage than now, or a short run of 120 miles will put him on Lake Huron, and thus within easy reach of Tonawanda, Buffalo, Cleveland, Detroit, Chicago, Duluth, Port Arthur, in short every market for lumber on the lakes.

In view of the magnitude of the lumber traffic and the immense advantages the proposed navigation will afford for carrying it on, it is reasonable to estimate that at least 1,000,000 tons will pass through the canals, west and east. This is probably far within the mark. The importance of this traffic lies chiefly in the fact that it will give a large, certain and steady revenue to the undertaking from the outset and before any very great development of other local trade can reasonably be expected.

The local traffic, exclusive of lumber and saw logs, consisting of ores, building stones, marbles, cordwood, pulpwood, bulky agricultural products, lumbermen's supplies, and other general merchandise, may be estimated at 250,000 tons and would no doubt rapidly increase.

To summarize the results of the examination, traffic both ways being understood to be included in every case:—

I.	From Lake Superior, one-twentieth.....	750,000 tons.
II.	" Lake Michigan, one-tenth.....	1,800,000 "
III.	" Lakes Huron and Erie (including coal trade).....	250,000 "
IV.	" Lumber trade.....	1,000,000 "
V.	" Other traffic of local origin.....	250,000 "
Total		4,050,000 "

(Of these it may be assumed that IV would remain stationary for some years (though probably underestimated), while all the others, and especially I and V would increase from year to year.)

Supplementary Report of Mr. Marcus Smith, M. Inst. C.E.

PRACTICABILITY.

1 There cannot be any doubt about this. The changes that will be required since Government surveys were made, between Lake Nipissing and the Mattawa River, through the construction of the Canadian Pacific Railway, the building of the Town of North Bay and the cultivation of the land on the North side of Lake Nipissing will not admit the raising of that Lake to the height proposed in the Reports of Mr. Shanly and Mr. Clarke. This will involve deep cuttings and therefore add largely to the cost of the works on that section; but it will greatly improve the navigation by reducing the lockage at least 36 feet (rise and fall 18 feet) on the summit level and insure an abundant supply of water from Lake Nipissing.

A change of the line of canal will also be necessary at Ottawa through the construction of the Canadian Pacific Railway, the canal for the City water works and other buildings which will also considerably increase the cost of construction of the canal.

CAPACITY (Proposed.)

2.	Length of lock	250 feet
	Clear breadth	45 "
	Depth of water on sill	9 to 12 feet.

The depth of canal and locks will have to be decided after full discussion with the Boards of Trade, and Forwarders as to what depth will be the most suitable and economical for the growing trade of the country, especially for the rapid increase of the grain trade of the Northwest Provinces. The Naval authorities should also be consulted as to the value of the canal for the passage of gunboats or other armaments for defence, within the limited depths of nine to twelve feet.

The natural depth of the waters of the lakes and rivers is suitable for a canal and locks of nine to twelve feet depth of water, with not a very great difference between them in the cost of construction. But for any depth above twelve feet the cost would increase rapidly not only in constructing the canals and locks but the lakes and rivers would in many places require dredging.

The dimensions of the locks between the Lachine Canal and Ottawa are:

Length of Lock	200 feet.
Clear breadth	45 "
Depth of water on sill	9 "

It probably would not be necessary to make any alteration in these till the new works above were far advanced.

3 LOCKAGE (approximate)		
Montreal Harbour	Lockage	No of locks
To Grenville	Lachine.....	45 00 feet
	Ste. Anne, Carillon, etc....	58 50 "
		<hr/>
Ottawa to summit level	103 50	13
at Lake Nipissing as altered.....	531 00	50
		<hr/>
Total rising		634 50
Lake Nipissing to mouth of	65 20	8
French River falling.....		<hr/>
Total	699 70	71

Travelling from west to east the heights of rising and falling will be reversed.

4 The number of locks will probably be reduced as the most modern approved methods will be used, and higher lifts made where the inclination of the ground is rapid or otherwise suitable not only for reducing the cost of construction, but for facilitating navigation.

5 The estimated cost of constructing the whole of the works with a depth of nine or ten feet of water on the sills of the locks has been \$15,000,000.

But for increased difficulties purchase of property, management, etc. \$16,000,000.

For twelve feet of water not less than \$18,000,000.

(With increased contingencies), probably \$19,000,000.

DANGERS OF DELAY IN COMMENCING THE WORKS.

6 The works should be commenced as soon as possible for new works, such as roads electric railways and buildings, will be constructed so as to interfere with the proper course of the canals and position of the locks and greatly increase the cost of constructing them; some of these properties will have to be bought, others diverted, or bridges constructed to pass them over the canal which will be all done at the expense of the Canal Company, as well as the salaries of gate-keepers. Much of which could be avoided if the Canal were the first constructed.

But more serious still may be the completion of rival canal schemes. The St. Lawrence River route gets but a small fraction of the traffic from the North-western States or Dominion Provinces. Most of it goes by way of Buffalo or Oswego to New York. That State has voted nine million dollars for the improvement of the Erie Canal to a depth of nine feet on the locks. If this line is completed before the Montreal, Ottawa and Georgian Bay navigation it will immediately take all or most of the Northwestern traffic to the seaboard, and notwithstanding that the latter offers far superior advantages it is difficult to divert traffic from a groove into which it has set—for forwarders will have gone to great expense in providing boats, steamers, offices and other accommodation to suit that route a great part of which would be a dead loss to them in making the change to another route. The produce of our Northwest Territories is just on the rising wave—let us prepare without a day's delay, for the full flood.

MARCUS SMITH,

OTTAWA, Feb. 1st, 1896.

McLeod Stewart, Esq.,

DEAR SIR,—In answer to your enquiry as to the effect the Ottawa navigation scheme would have on the business of exporting cattle, I may say I believe it would revolutionize that trade. With fast boats specially built for carrying live stock, making the distance from Chicago to Montreal in less than 100 hours, the Ottawa River and Canal would compete strongly for the traffic. These boats could be thoroughly ventilated and easily kept clean. Cattle could be given more space than on the cars, the facilities for feeding and attending them would be better, they would be kept much cooler in the hot weather, and always have better air, which would result in their reaching Montreal healthier and in very much better condition to stand an ocean voyage.

The route being for the most part land-locked, with deep cool water, and not subject to the extreme heat of more southerly routes, would be very safe, and would afford the best possible conditions for the successful shipping of live stock.

And the cost of carriage being less than half or perhaps not more than one-third of that by rail, there would be a large amount saved to the stock-raiser on every shipment. Being a day and a half shorter than the Welland and St. Lawrence to Montreal, and from four to five days shorter than the Erie to New York, the Ottawa is the only waterway on which that business could be successfully done, and its success would make Montreal the most important cattle shipping point on the continent.

Yours truly

EDWARD DEVLIN, Sr.